1990. Pgs. 6-7 in Proceedings of the Seventh Midwest and Third Southeast Furbearer Workshop (February 27-March 2, 1989, Potosi, MO)

CONTROL OF RABIES IN WILDLIFE BY ORAL VACCINATION

Samuel B. Linhart - USDA, APHIS, Denver Wildlife Research Center, Denver, CO 88225-0266
Jean S. Smith - USPHS, Centers for Disease Control, Rabies Laboratory, Atlanta, GA 30301

Rabies in wildlife is found throughout much of the world. Mongooses, jackals, wolves, desert, red, and arctic foxes are the major carriers in Africa, Asia, and Europe. Skunks, raccoons, red, gray, and arctic foxes, and various bat species are the main problems in North America. Vampire bats and mongooses are the principal species of concern in South America and the Caribbean islands, respectively. The distribution and incident of the disease are poorly documented in much of the world, especially in third world countries where urban dog rabies and human exposures, not wildlife rabies, are the major concerns.

Identification of different strains of rabies virus is now possible and has greatly increased our understanding of the epizootiology of rabies in wildlife. The technique involves determining the reaction of a given virus isolate to a panel of monoclonal antibodies specific for non-overlapping antigenic sites on the viral N protein. Patterns of positive and negative reaction to individual antibodies in the panel distinguish viruses from different enzootic areas. This research has shown that five strains of rabies virus are present in terrestrial wildlife within the contiguous United States; one in arctic and red foxes in Alaska and in red foxes in New York, one in raccoons in mid-atlantic and southeastern states, one in gray foxes in Arizona, and two in skunks, one in the southcentral states and another in the northcentral states and California. Several additional strains have been characterized for bats and identifying species-defined enzootics in the lasiurine group and in Eptesicus, and Tadarida spp. Although sporadic cases of rabies transmission from bat to terrestrial animal have been identified, rabies apparently cycles independently in bats and terrestrial animals and rabid bats do not contribute to enzootic maintenance of rabies in skunks, raccoons, or foxes in the United States.

New rabies vaccine technology and progress in developing bait and appropriate baiting strategies for several species has indicated a high potential for oral rabies vaccination of wildlife. The approach has several advantages not shared by population reduction techniques. These include maintenance of more stable vector population by immunization as compared to increased population turnover, higher reproductive rates, greater movement and more transient individuals that normally result from intense efforts to reduce the number of individuals in susceptible population.

The first attempt to orally immunize wildlife was in 1971 when captive red fox were successfully immunized by investigators at the Centers for Disease Control. Shortly thereafter, european collaborators began similar studies and Switzerland (1978) and Germany (1983) became the first two countries to successfully suppress fox rabies with an orally effective live rabies vaccine. Rabies in red foxes and raccoons in Ontario have resulted in intense efforts by the Canadians to develop orally effective vaccines, baits and aerial baiting techniques. The mid-atlantic raccoon rabies outbreak resulted in two field studies by the National Park Service and the state of

Virginia to determine the feasibility of orally vaccinating raccoons. Both involved distributing baits containing a biomarker and the subsequent capture of animals to determine the percent that ingested baits. The Wistar Institute in Philadelphia, based upon extensive laboratory and field research efforts, is seeking USDA approval to conduct field tests on three offshore barrier islands located in Virginia and South Carolina. The request has generated some controversy because one of the two experimental vaccines is a recombinant or genetically engineered vaccine. Concerns about recombinant vaccines center about the difficulty in controlling the spread of a virus once it is introduced into the environment, its potential pathogenicity for humans and non-target animals, and the possibility of enhanced virulence through mutation, after its introduction into the environment. Development of recombinant vaccines involves the replacement of a non-essential gene in a parent vaccine virus with a foreign viral gene. In the Wistar Institute studies, for example, the thymidine kinase gene of Vaccinia virus (a small-pox vaccine virus) was replaced with a copy of the gene encoding the rabies glycoprotein (the rabies protein which elicits virus neutralizing antibody).

Although research conducted to date has indicated a high potential for orally effective rabies vaccines, much more remains to be done. An effective and inexpensive vaccine, baits readily accepted by target species, baiting strategies that selectively reach a high proportion of the target population, acceptable safety considerations, and favorable cost-benefit analyses are all required before the widespread use of oral rabies vaccines becomes a reality.